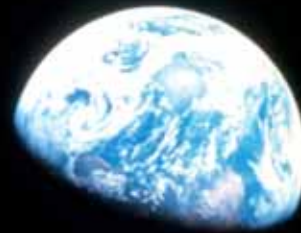


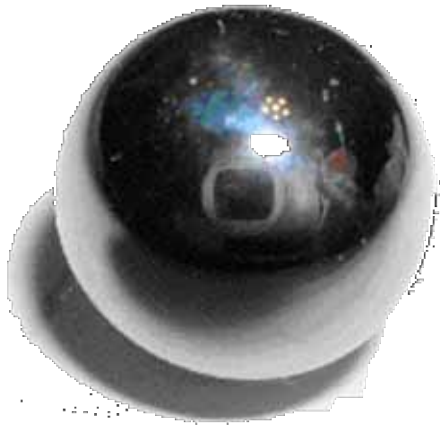
Insurance & Climate Change

Proactively and Profitably Managing The Risk

Evan Mills, Ph.D.
Staff Scientist
University of California
U.S. Department of Energy
Lawrence Berkeley National Laboratory



Our atmosphere is as thin -- in proportion to the Earth's diameter -- as a film of condensation on a steel ball.





From Thunder to Underwriting

Natural Phenomenon

(e.g. temperature increase)

Variability/Uncertainty

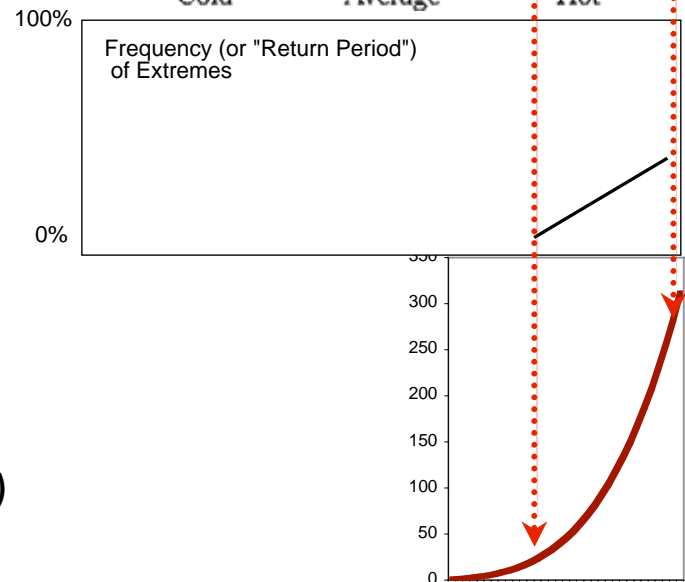
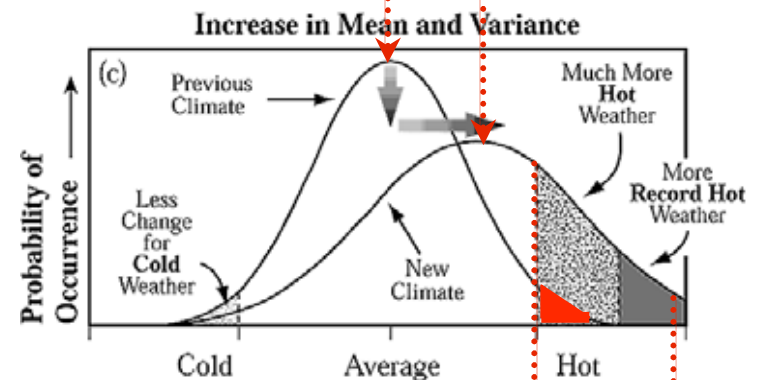
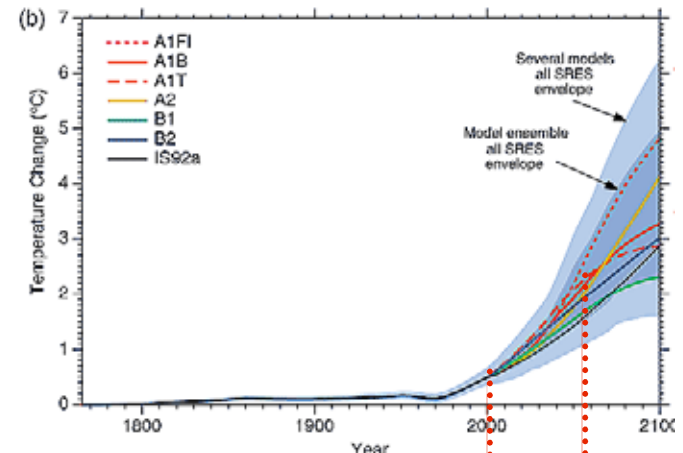
(e.g. temperature extremes)

Change in Likelihood of Extremes

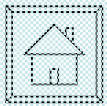
(e.g. return period of heat waves)

Impact / Insured Loss

(e.g. loss of life; business interruption, etc.)



Insurance-relevant Consequences



Property Insurance

- Property damage
- Mold/moisture
- Forest products
- Agricultural losses
- Business interruption
- Roadway



Life/Health Insurance

- Injury
- Infectious disease
- Heat stress
- Respiratory
- Pollutant releases
- Food poisoning
- Mental health
- Nutrition/water



Liability Insurance

- General
- Product
- Environmental
- Professional
- Political Risk
- Roadway

Climate Change Liability: A Rapidly Emerging Issue

New IPCC Report has reduced the uncertainties

Business Insurance
February 5, 2007 www.businessinsurance.com

ANOTHER APPEALS COURT RULES CASH BALANCE PLANS DON'T DISCRIMINATE / PAGE 3 **FINANCIAL GUARANTEE INSURER PAYS \$75 MILLION TO SETTLE FINITE CHARGES / PAGE 3** **RADIO STATION RISK MANAGERS TO INCREASE ON-AIR OVERSIGHT AFTER CONTEST TRAGEDY / PAGE 3**

In Brief

Mich. court rejects same-sex benefits

Michigan's 2004 marriage amendment prohibits public employers in the state from offering health benefits to employees' same-sex domestic partners. The Michigan Court of Appeals says, in a unanimous, 11-0 decision last week in *Anderson v. Board of Directors of Michigan and City of Nantawan*, a three-judge panel held that public employers and their recognized domestic partnership agreements for the purpose of providing benefits "inextricably related to the performance of the employment."

Uias claims up in 2006: EFCC

A total of 75,768 discrimination charges were filed with the U.S. Equal Employment Opportunity Commission last year, a 10% increase from 2005.

See IN BRIEF page 12

U.N. climate report stirs liability fears

Scientific testimony may fuel lawsuits on global warming

By ROBERTO CENIGEROS

The publication of a U.N. report last week linking human activity to global warming "will be enough to cause immediate liability problems for industrial companies, but it also increases the chances of more claims filtering through to insurance policies in the future, some experts say.

The report, which links the burning of fossil fuels with more extreme climate conditions, may increase the likelihood that commercial policyholders and their liability insurers will have to fund more defenses against alleged

climate change liability. It was the main reason that global warming played a role in causing Hurricane Katrina, which damaged the homeowners' properties.

The lawsuit, which Texas voters brought to court through ballot initiative, represents a first step across the line for what has been the leading litigious battleground for global warming-related lawsuits, said David Dushoff, president of American Risk Management Resources Network LLC, a Madison, Wis.-based environmental wholesale brokerage.

In addition, last year, then California Attorney General Bill Lockyer sued several Japanese and U.S. auto manufacturers and U.S. auto manufacturers said G. Andrew Lundberg, a partner in the law firm of Putnam & Watkins LLP in Los Angeles, and lawsuit alleged that the

Marsh reaps \$3.9B with Putnam deal

Investment firm sale will sharpen focus, boosts war chest

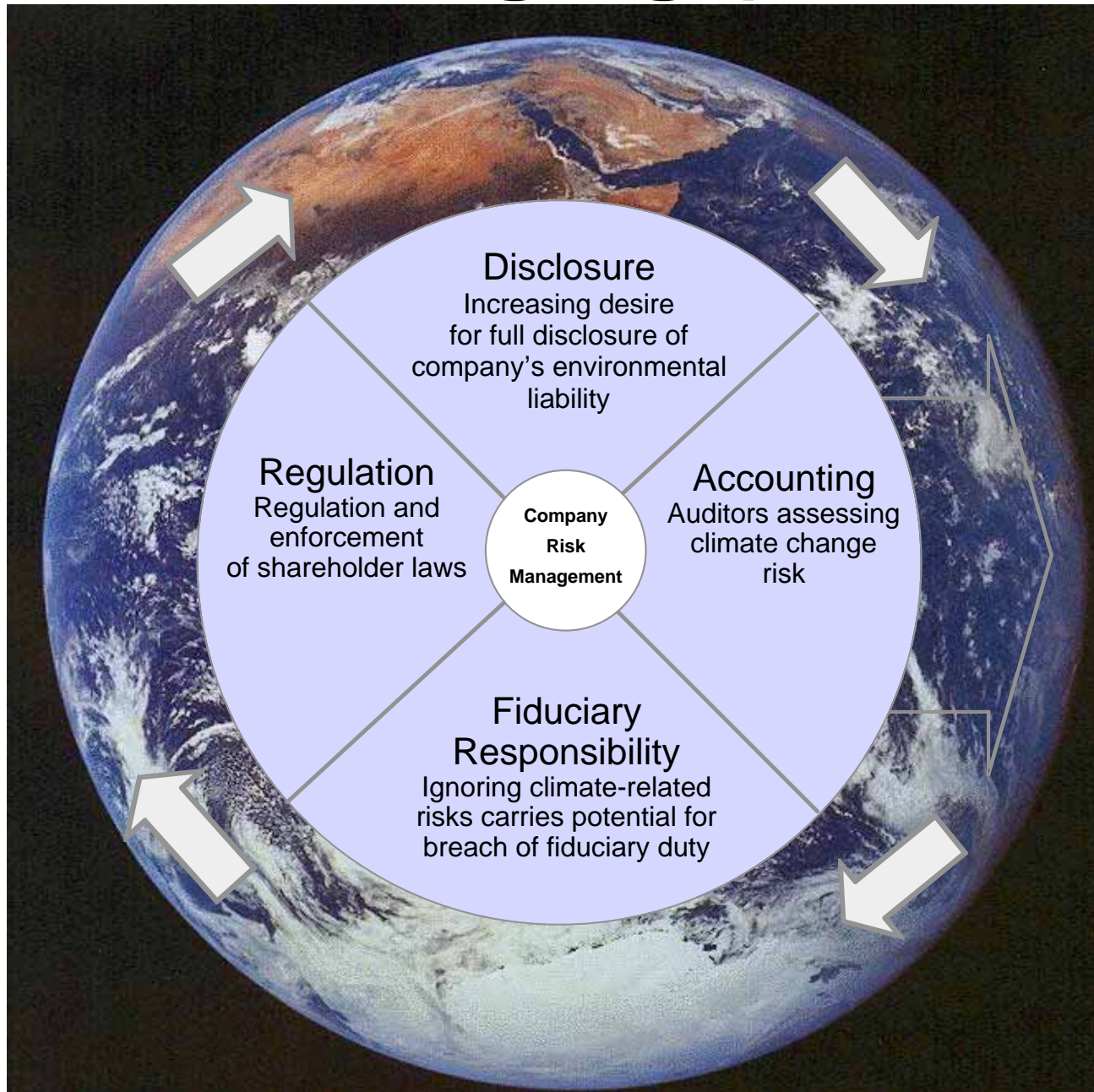
By SALLY ROBERTS

NEW YORK—Marsh Inc. announced last week that its sale to Putnam Investments, the investment management and financial services firm, will make the insurance manager of more financial analysts say.

Marsh, based in Boston, will be sold to Putnam, a New York-based investment firm, for \$3.9 billion, the highest price ever paid for an insurance company, according to analysts.

Marsh Inc. has been under pressure to sell since it filed for Chapter 11 protection in 2005. Marsh Inc. has been under pressure to sell since it filed for Chapter 11 protection in 2005.

The Changing (Business) Climate



Business Valuation

- Negative impacts on company value, reputation & brand caused by ignoring climate change

Shareholder & Institutional Investor Demands for Action

Shifting Regulatory Environment

- Energy prices
- Carbon caps, etc.
- Corporate governance
- Compliance cost

Insurers: Reasons for Concern

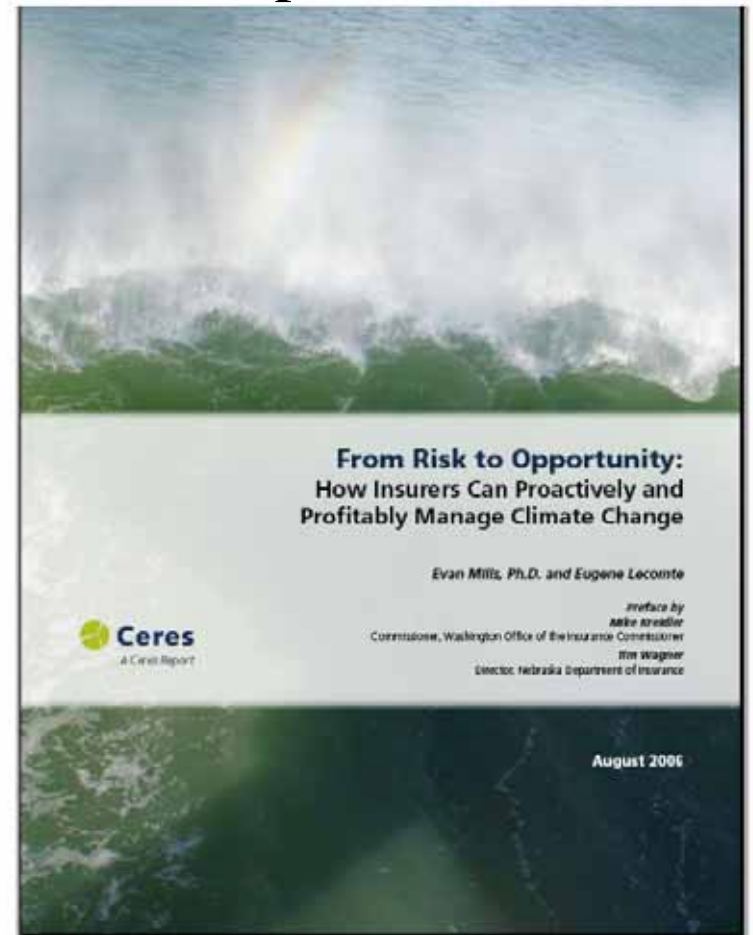
- Actuarial - losses in all lines (core business)
 - increased variability
 - unexpected correlation
 - affordability/availability
 - potential for abrupt change
 - CAT model deficiencies
 - difficult to function post-loss
 - data “blind-spots”
- Contraction
- Competitive risk
- Regulatory risk
- Reputation risk
- Own liability
- Assets & share prices are weather-sensitive; Ratings
- Macroeconomic downturn

From Risk ... to Opportunity

“The insurance sector has a key role to play in helping to mitigate the effects of climate change ... and by developing new products and solutions that can support emerging greenhouse-gas and renewable energy markets.”

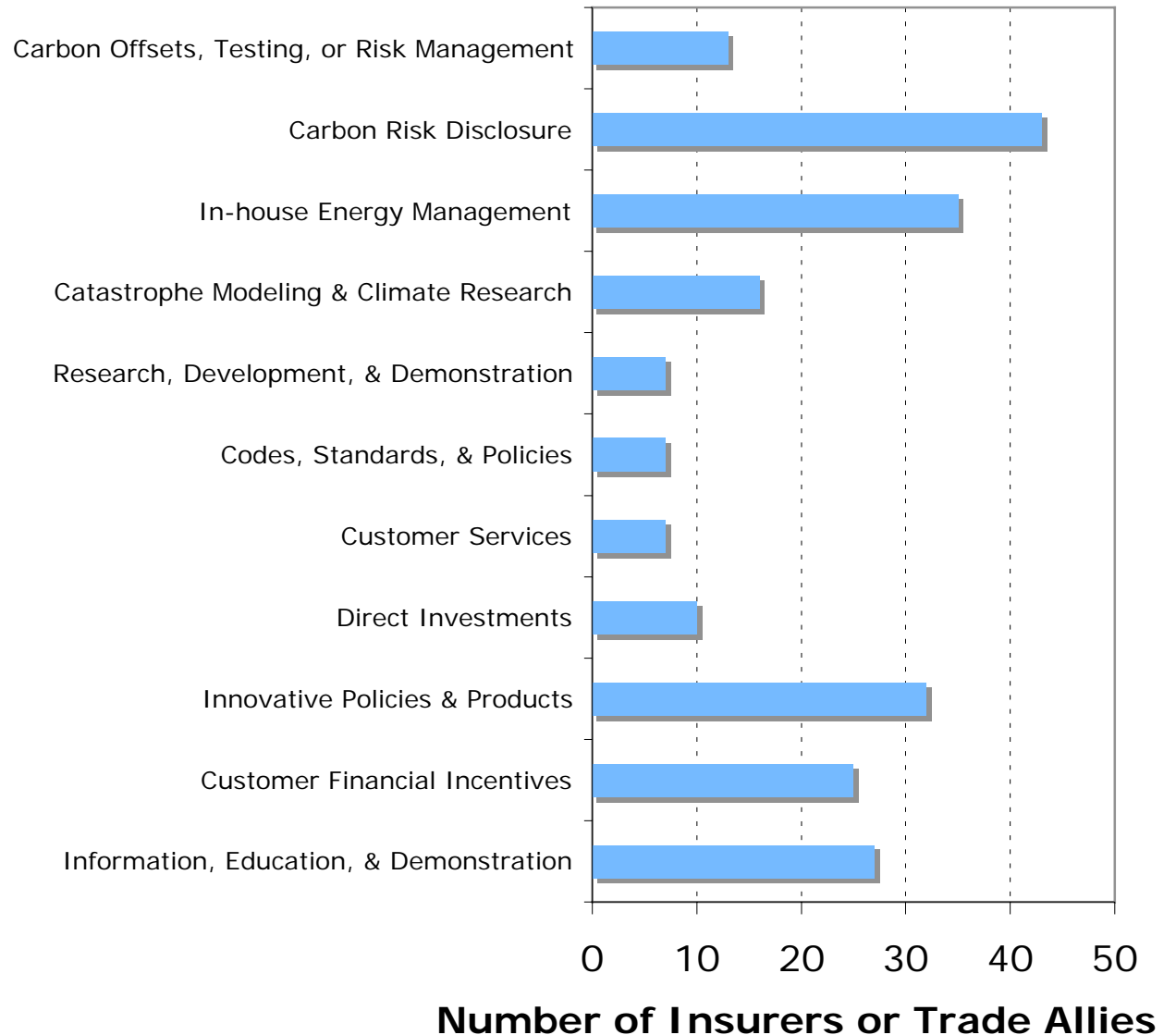
- Marsh & McLennan

Report: 25 strategies;
~225 examples; ~130 insurers



Range of Activities

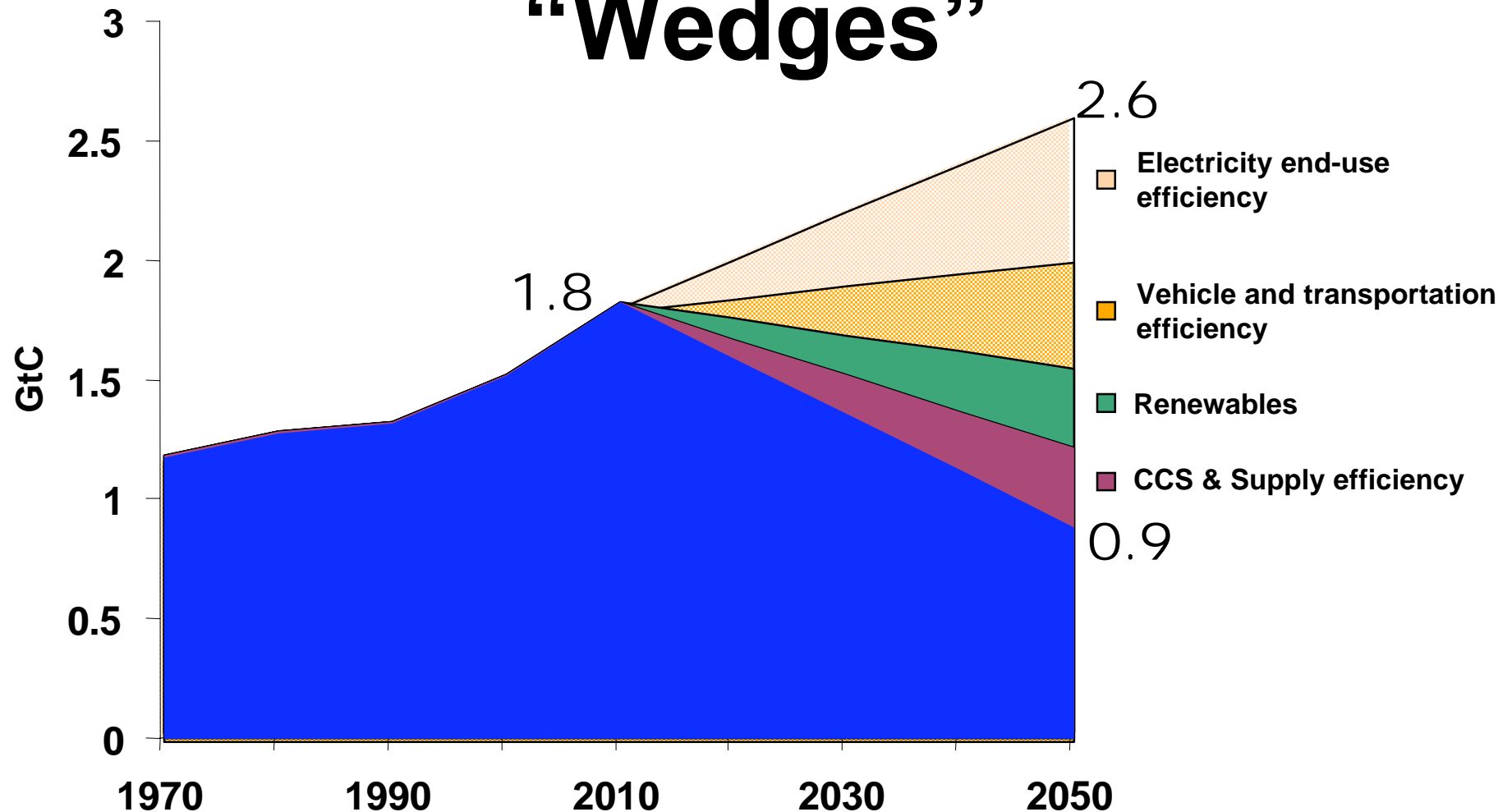
- Australia
- Belgium
- Canada
- Switzerland
- China
- Germany
- France
- Italy
- Israel
- Japan
- Netherlands
- Norway
- South Africa
- Sweden
- Taiwan
- United Kingdom
- United States



New Customers for Traditional Business

Cutting U.S. Emissions in Half with Climate-Stabilization

“Wedges”



After Pacala and Socolow (*Science*)

Renewable Energy Projects



The strength, experience and flexibility to protect business against risk.

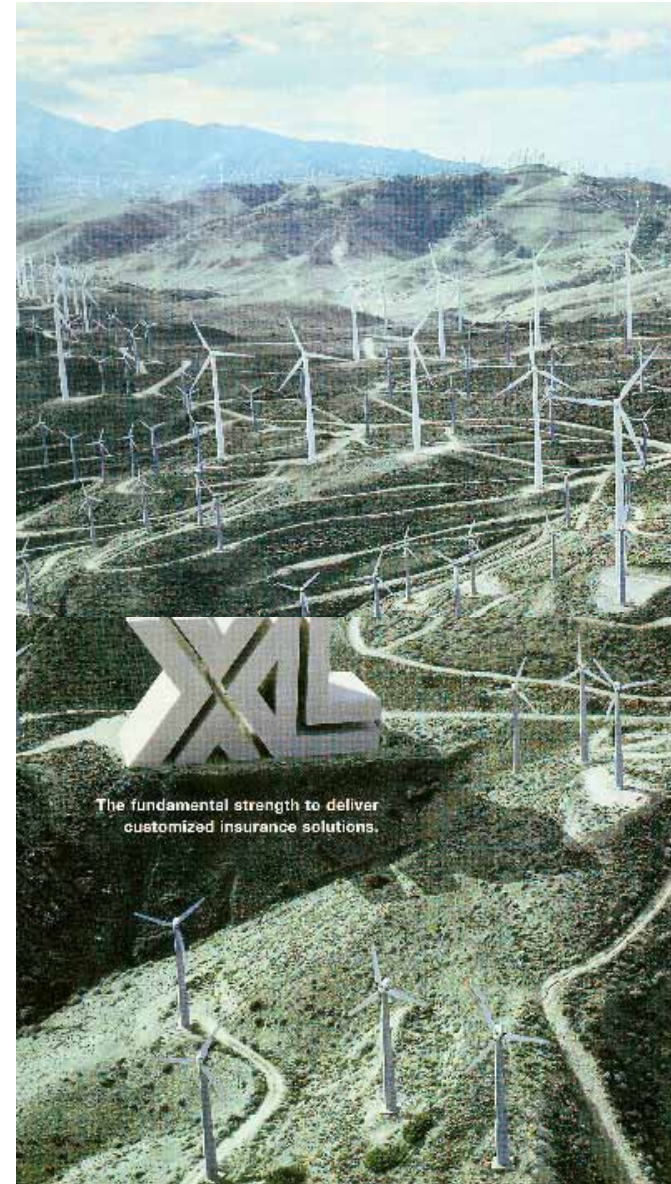
PROPERTY | CASUALTY | PROFESSIONAL | SPECIALTY

The XL Insurance Companies are one of the world's leading insurers, offering a wide range of insurance products to protect your business against a variety of risks. Our products include Property, Casualty, Professional and Specialty insurance, providing comprehensive coverage for your business.

XL Insurance Companies is your partner in providing the best possible insurance solution for your business.

For more information, please contact your XL Insurance Company representative.

XL INSURANCE
THE ONE WAY TO PROTECT



The fundamental strength to deliver customized insurance solutions.

THE XL INSURANCE COMPANIES are chosen by the world's leading firms not only for the strength of our capital and the depth of our experience, but also for the quality and variety of our products.

PROPERTY
General All Risk Property Damage & Business Interruption | Energy & Construction All Risk | Fine Art | Cargo In Transit

CASUALTY
Primary Liability | Global Public & Products Liability | Automobile Liability | Insurance & Reinsurance

PROFESSIONAL
Directors & Officers | Employment Practice Liability | Errors & Omissions

SPECIALTY
Aviation & Space | Environmental Liability | Marine | Marine Cargo | Programs

people providing tailored solutions and services to meet your individual insurance requirements. If you expect more, visit www.xlinsurance.com or call us toll-free: 800-606-2610.

For XL Insurance Services, visit www.xlinsurance.com or call us toll-free: 800-606-2610.

XL INSURANCE
FUNDAMENTAL STRENGTH - CAPITAL AND PEOPLE

Renewable Energy Project Insurance

Cumulative availability (e.g. 77% of insurers offer property damage for onshore wind projects).
Full penetration of all forms of insurance would correspond to 800% on the x-axis.

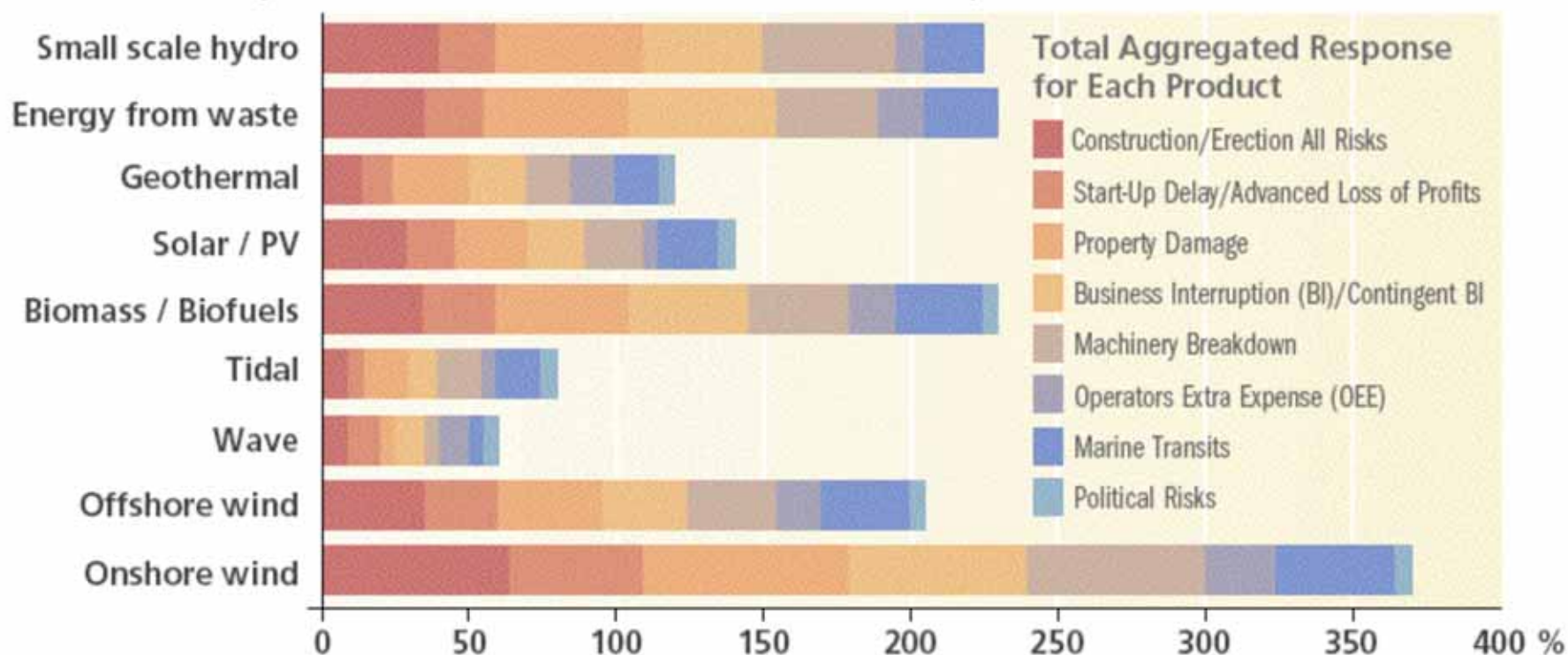


Figure 6. Availability of insurance products for different renewable energy technologies

Source: Marsh, 2006. "Survey of Insurance Availability for Renewable Energy Projects." March, 15pp.

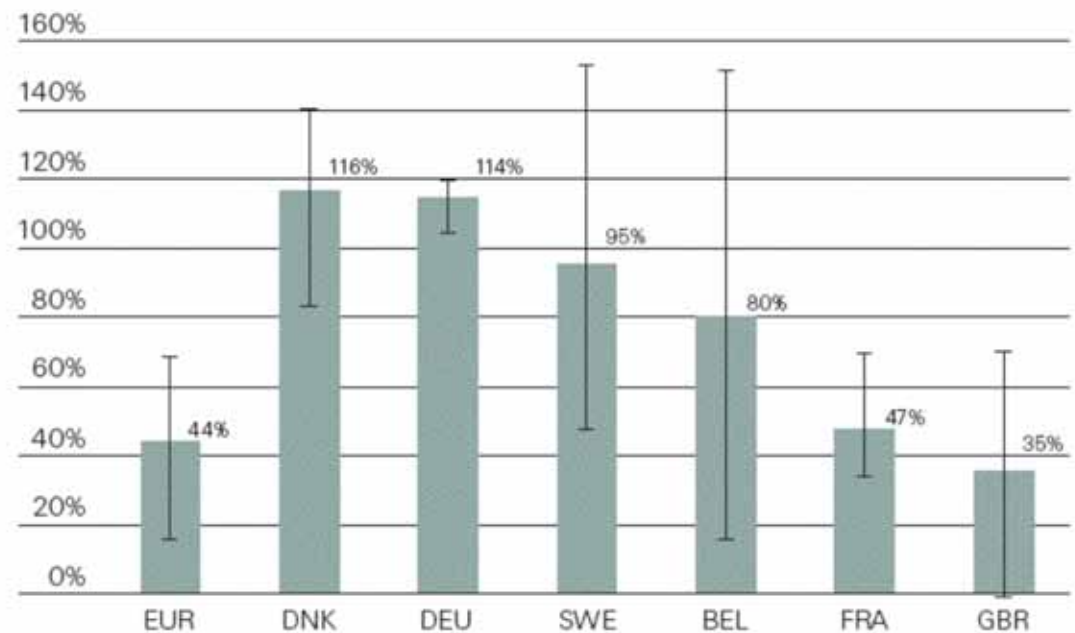
Conducting Research, Development, & Demonstration

Catastrophe Modeling & Climate Research for Risk Management

- *Efforts underway:*

- *AIG*
- *Lloyds*
- *Munich Re*
- *Swiss Re*
- *Willis*
- *RMS*

Expected increase in annual loss in Europe



Increase in annual expected loss for Europe (EUR), Denmark (DNK), Germany (DEU), Sweden (SWE), Belgium (BEL), France (FRA) and the UK (GBR) over the period 1975 to 2085 (in %). The broad bars represent the mean value of the climatic models, and the error bars show the spread of the results from all models

Disaster-relief Technology

- *IBHS & USDOE* - collaborated in development of energy-efficient, UV water disinfection for emergency relief situations



Promoting Loss Prevention

Traditional Risk Management

- Meets *Institute for Business and Home Safety*: “Fortified... for safer living” stds.
 - Wind-resistant rigid foam panel walls and multi-glazed windows
 - Ice-dam resistant
 - Mold resistant
 - Water-resistant insulation

BASF Home - Patterson NJ



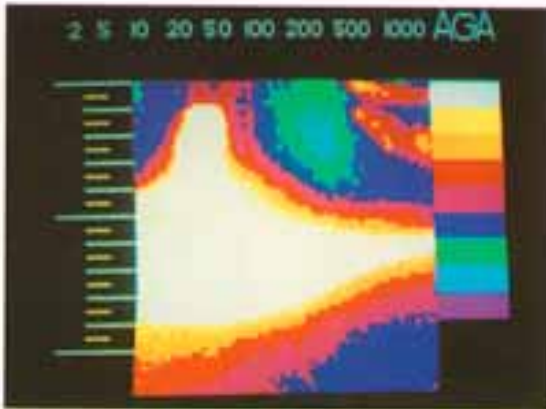
Some insurers are giving premium credits....

Integrating Energy Management & Risk Management

Munich Re Brochure circa 1995 on Infrared Cameras

3 Thermographic inspections in the construction trade and water installations

Insulation faults, heat build-up, and excessive moisture in masonry and roof structures can be identified by means of a special application and this can contribute to energy savings.



Thermogram of a leak in a warm water pipe laid in the floor.

Leakages in heating installations, water systems, and sanitary installations can be located quickly and accurately.

● A leak in the warm water system in the sanitary area of a commercial firm would have necessitated opening up large areas of the floor in order to find the leak if had not been for thermography. An infrared in-



Leak after opening up the floor.

spection showed up the leak as a "warm spot" in a bend. All that had to be done was open up a floor slab measuring 60 by 60 cm in order to gain access to the place where the water was coming out and repair the leak.

This example shows that once leaks have been located using thermography, pinpointed repairs can be carried out, thus avoiding the high cost of tearing open and replacing expensive floor coverings.

4 Closing remarks

Thermography can be used to draw the thermal profile of technical objects while they are in service. Proper analysis of the data gathered in the inspection reveals thermal faults before they can cause a loss. Infrared thermography should therefore be viewed both by insurers and by their clients as a valuable part of the toolkit for non-destructive loss prevention.

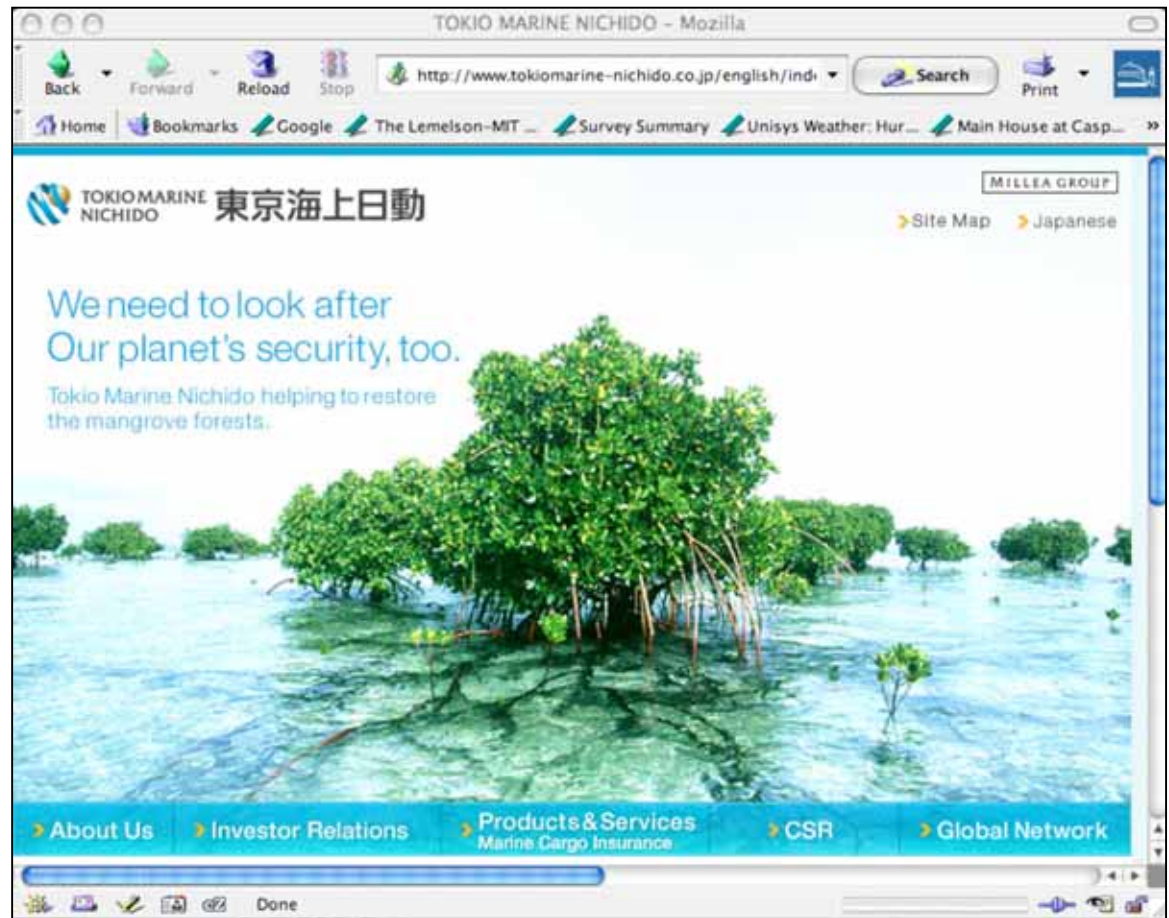
Energy-Efficiency --> Fire Safety

- *Arkwright Mutual (now part of FM Global):* replaced fire-hazardous halogen “torchieres” with compact fluorescent alternatives at Northeastern University student housing + seminars for risk managers



Better Management of Forestry, Agriculture, and Wetlands

- *Tokio Marine & Nichido*: reforested 7,500 acres of mangroves in Indonesia, Thailand, Philippines, Myanmar and Vietnam. 5,000 more in progress



Source: <http://www.tokiomarine-nichido.co.jp/english/index.html>

“Rebuilding Right” Following Losses

- ***Fireman's Fund***: first-ever “Green-Buildings Insurance”
 - Rebuild green after loss

Very popular:

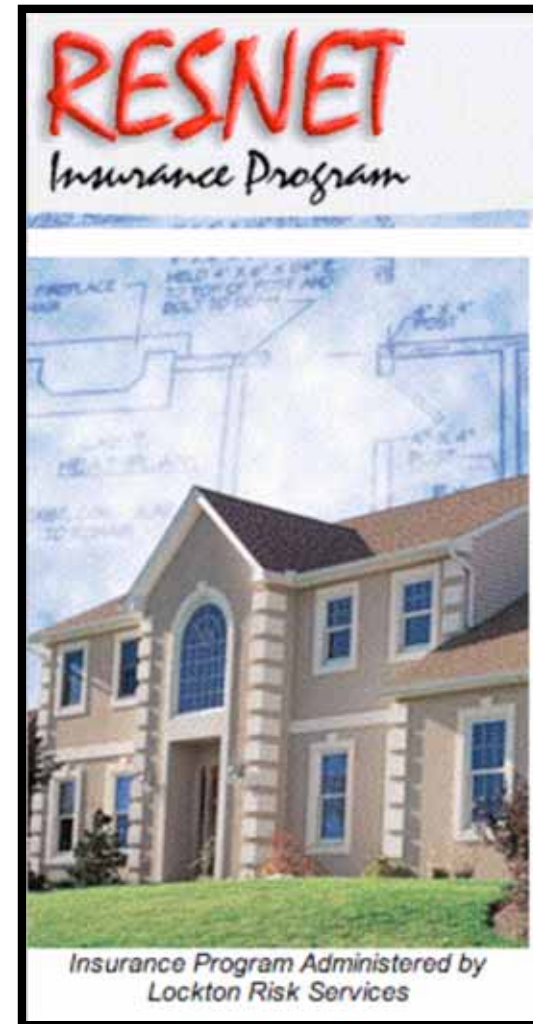
- > \$5,000,000 of new business in first 6 months;
- > Instrumental in renewals;
- > Wall Street Journal



Crafting Innovative Insurance Products and Services

New Products for Energy Service Providers

- ***Lockton Risk Services:*** group liability coverage for home energy auditors, if members of RESNET



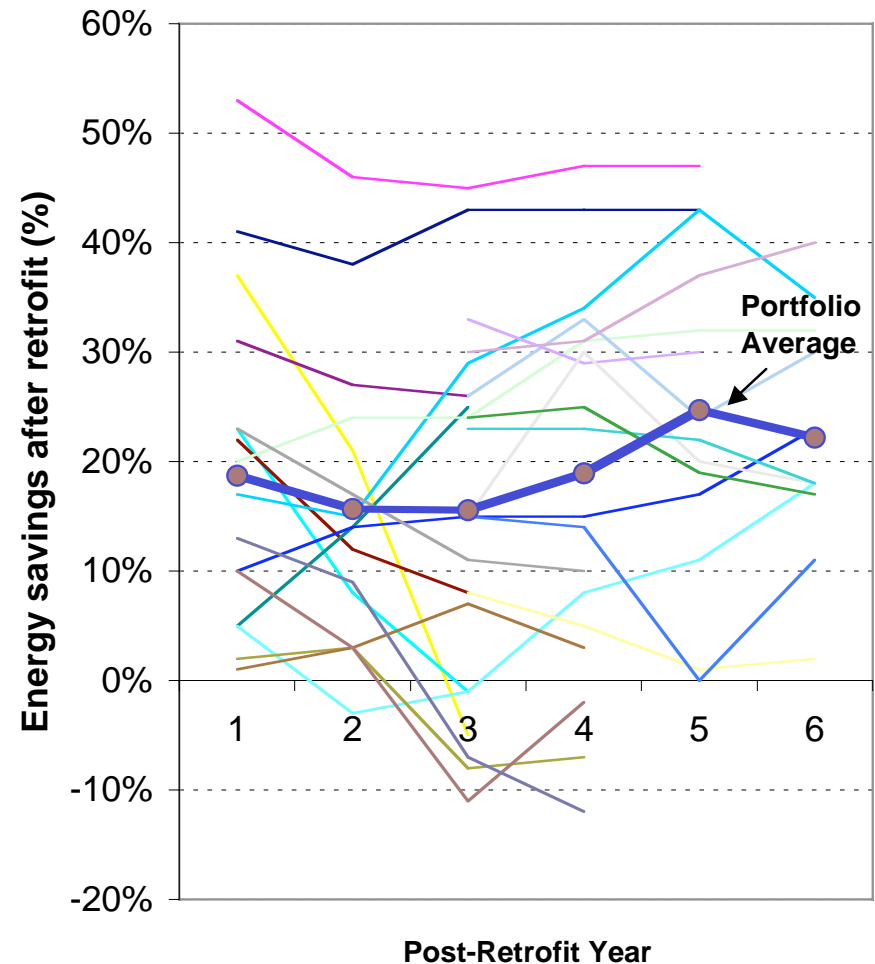
Source: <http://www.locktonaffinity.com/RESNET/>

Energy Savings Insurance

- *Lloyds*, and various others....
- Owner-advocate
- Enhances “bankability”
- Small step to extend from energy to carbon warranty

Mills, E., S. Kromer, G. Weiss, and P.A. Mathew. 2006.
"From Volatility to Value: Analysing and Managing Financial and Performance Risk in Energy Savings Projects." *Energy Policy*, 34:188-199.

Variation in Weather-Normalized Energy Savings in 24 Public Housing Projects, versus Portfolio



Renewable Energy Performance Insurance

- *Munich Re:*
Piloting
geothermal
energy
exploration risk
insurance



Green Buildings Insurance

- ***Lloyds of London (Naturesave)***: personal lines; commercial lines
 - 10 percent of premiums donated to environmental projects
 - environmental performance surveys offered to policyholders
- ***Fireman's Fund***: commercial lines - premium credits for “LEED-certified” buildings



Pay-As-You-Drive Insurance

- Insurance discounts of up to 40% for low mileage:

- **GMAC**
- **Progressive**
- **Norwich Union**
- **Polis Direct**
- **Rheinland Versicherungen**
- **Aioi**
- **Pay-per-K**
- **Hollard**
- **Gerling**
- **Unigard**



General Motors Acceptance Corporation
(GMAC) PAYD discount schedule.

Miles/year	Discount offered
1 – 2,500 miles	40%
2,501 – 5,000	33%
5,001 – 7,500	28%
7,501 – 10,000	20%
10,001 – 12,500	11%
12,501 – 15,000	5%
15,001 – 99,999	0%

Some use GPS --> avoids reporting fraud

Climate Change Insurance

- ***Munich Re:***
Climate insurance
Initiative (MCII) for
under-served
markets in
developing
countries
 - New products
 - Loss reduction
measures



Munich Climate Insurance Initiative

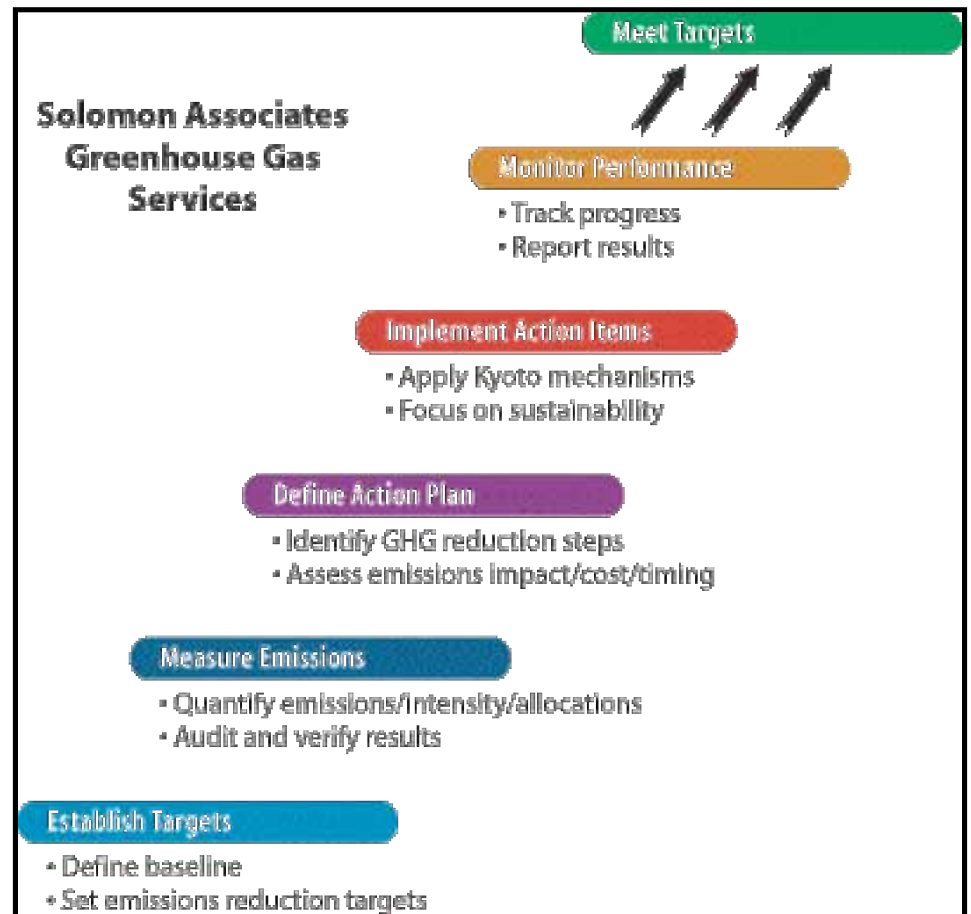
Mission statement



Offering Transactional and Risk-Management Services for Carbon Markets

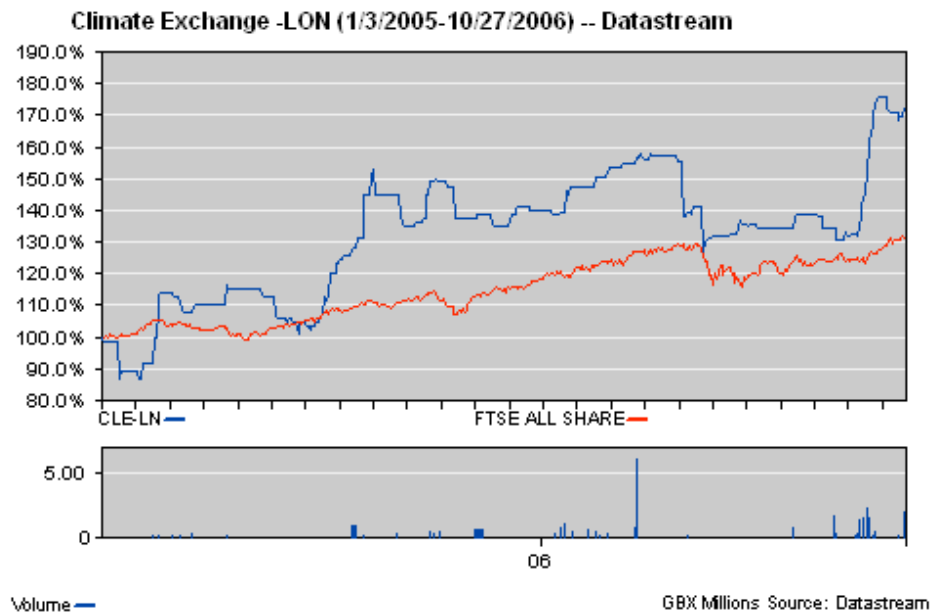
Climate Risk-management Services

- **Solomon Associates, subsidiary of HSB (AIG):** Greenhouse Gas Services
- **AON:** Climate Change Solutions Group



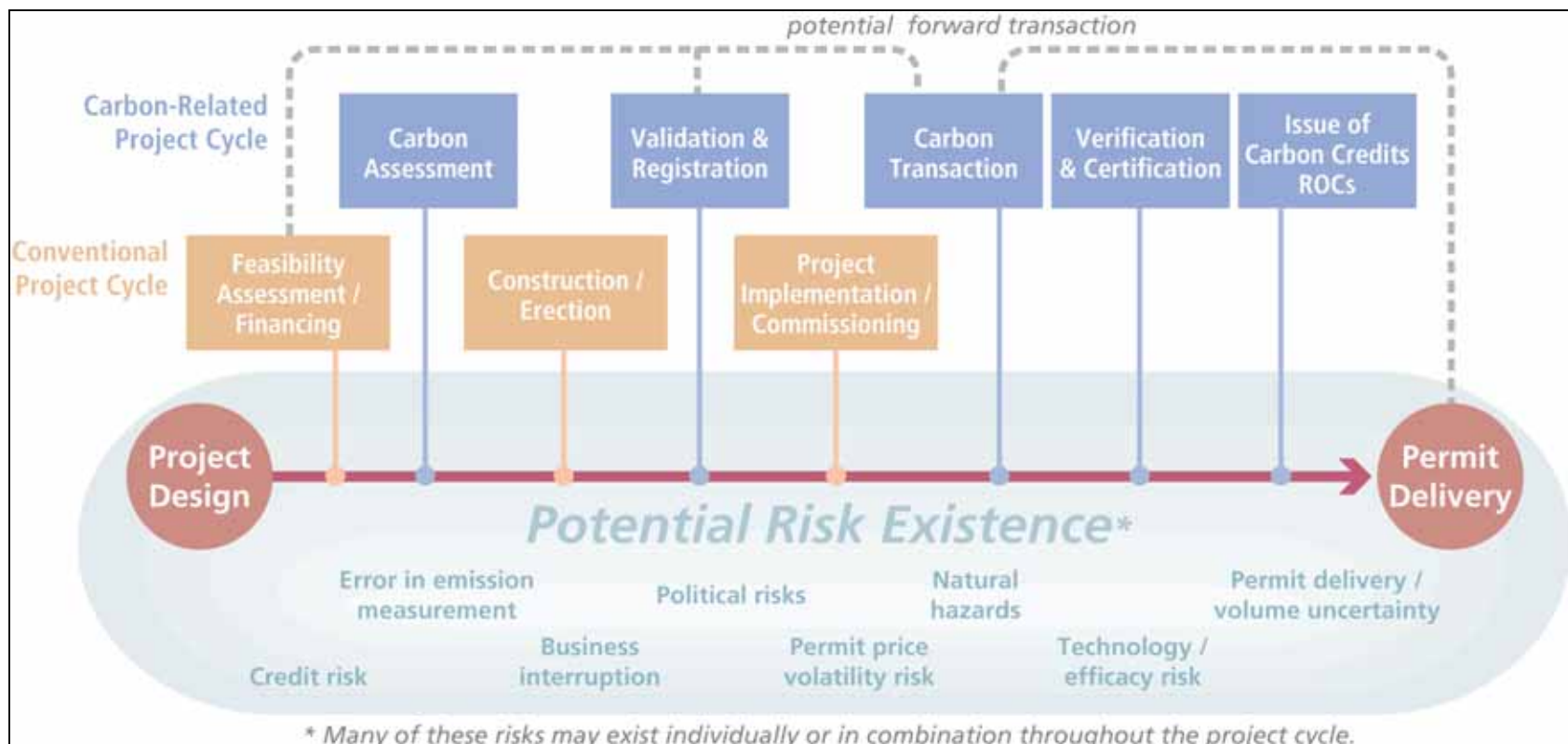
Facilitating Carbon Trading

- *Swiss Re:*
 - Contingent-Cap Forward for Emissions Reduction Trades (cost risk hedge)
 - Carbon credit price volatility product
 - Carbon-delivery insurance



Managing Risk for Clean-Development Mechanism (CDM) & Carbon-Trading Projects

- *Marsh* risk management service



Source: Marsh. 2004. "Responding to Climate Change Risks and Opportunities."

Enabling Customers to Purchase Carbon Offsets

- **Insurance Australia Group:** on-line automobile carbon-offset service for customers

Calculate your CO₂

Offset your emissions

Take our survey

Play the game

Climate Help

- Climate change
- Going carbon neutral
- What we're doing
- How you can help

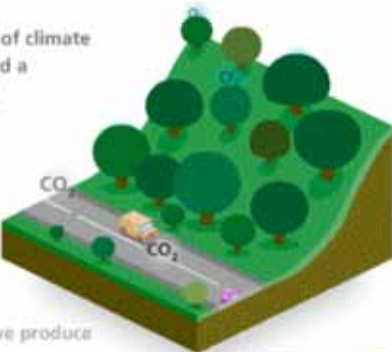
FAQ

Contact

Don't underestimate the effects of climate change.

With recent events like Hurricane Katrina, persistent droughts, and worsening bushfire seasons, there are now more signs than ever that our climate is changing.

Because cars are a significant cause of climate change, NRMA Insurance has created a new environmental program called Climate Help. It shows you how to offset your car's emissions, and how to help combat climate change with a unique method called carbon credits.



Forests reduce the CO₂ we produce

Next >



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Climate Help

Pay for your emissions

Back to Climate Help

Paying for your emissions is one of the simplest things you can do to help the environment. And we've tried to make it even simpler by allowing you to pay online with your credit card.

It's good to know you're doing the right thing, so we can also send you a certificate confirming that your car emissions will be offset. Just check this box on the next page and we'll email it to you in PDF format.

Calculate your CO₂

Choose your car type [View help](#)

Small

How far do you drive each year? [View help](#)

Between 10,000 kms and 15,000 kms per year

Your car emits 2.1 tonnes of CO₂ emissions annually

To offset your emissions for 12 months you need to pay \$32.93*

*It costs \$13.68 to offset one tonne of CO₂

Pay for your emissions

Title First name Surname

Mr Email Age

18-24 years

Are you an NRMA Insurance customer? Are you an IAG staff member?

Yes No Yes No

Name on credit card Credit card number Expiry Date Credit Card Type

01 / 06 Please select

We do not accept AMEX or Diners Club

You are paying \$32.93

Next >

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Source: <http://www.climatehelp.com.au/>

Aligning Terms and Conditions with Risk- Reducing Behavior

Assigning Directors & Officers Liability


- **Swiss Re:** added climate change to its primary insurance D&O underwriting process
 - Reviews CDP response (if available)
 - May request completion of questionnaire

Questionnaire

- Countries/jurisdiction of company operations
- GHG accounting/reporting system
- Gases assessed
- Outline of company intentions to address regulation-related potential liabilities
- If available, report of data: (1) Gross emissions; (2) GHGs/\$ gross revenues; (3) GHGs/\$ EBITDA; (4) GHGs/\$ current assets; (5) GHGs/\$ long-term debt; and (6) GHGs/\$ market cap

Recognizing and rewarding correlations between sustainable practices and a low risk profile

- **Travelers:**
10% auto
premium
discount to
drivers of hybrids



**Goes beyond fossil fuels.
And fossil insurance policies.**

It's just what the insurance world needs—more blue sky thinking. At Travelers, we're always working to identify changes in the world and to make sure your policies stay in-synch. From the discount we offer forward-thinking hybrid drivers to our monitoring of new risks, we help insurance keep up with life—whatever the road ahead may bring. Call an independent agent. After all, your world is always evolving. So should your insurance.

TRAVELERS
Insurance. In-synch.™

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Investing in Climate Change Solutions

Equity Investments

- **Swiss Re:** participated in an \$18.4 million round of financing in Evergreen Solar
- **Gerling:** Sustainable Development Project operates a \$100 million initiative including venture capital for new technologies to help address climate change risks
- **Allianz:** plans to increase investments in renewable energy by 300 to 500 million euros

Sustainable Asset Management

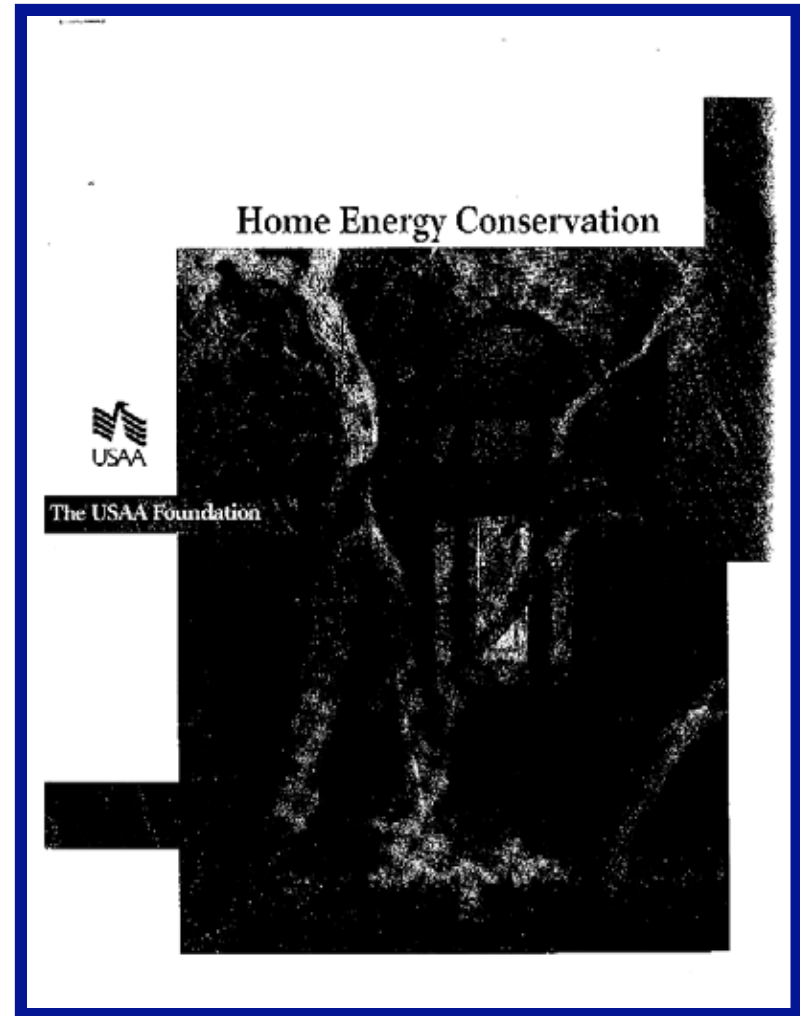
- **Munich Re:** membership in sustainable investment indices; screens its own investments
- **Allianz:** invested 10 million euros in the European Carbon Fund
- **Gerling:** Select 21 Fund includes energy and environmental criteria in the selection of securities



Building Awareness

Consumer Information & Education

- **USAA:** Energy-efficiency information to homeowners



Educating Fellow Insurers

- **Swiss Re:**
has run *regular*
full-page adds on
climate change in
major U.S.
insurance trade
journals for
several years

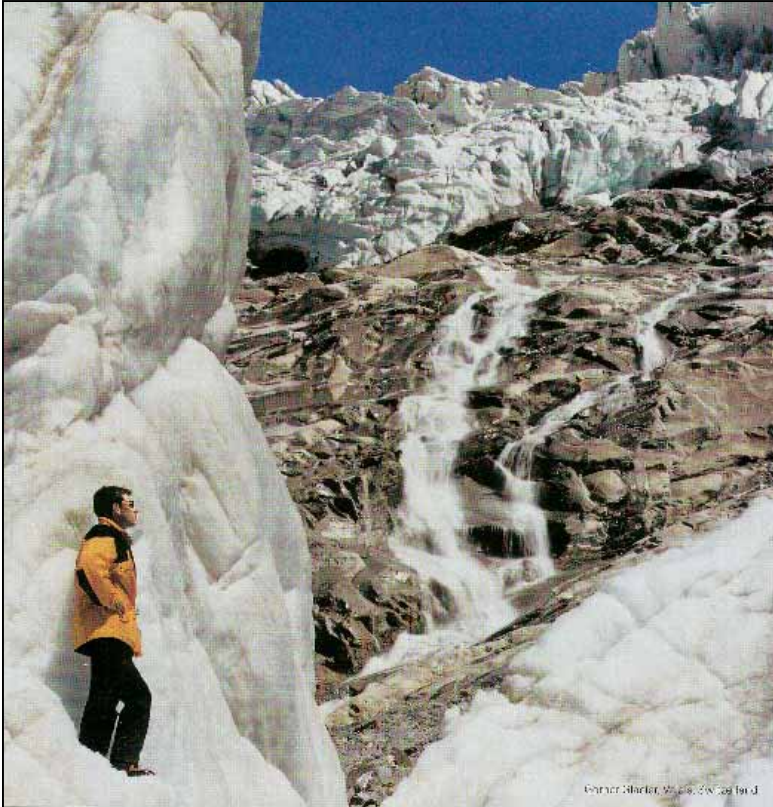



Photo: Michael Weiss, Swiss Re AG

Ivo Menzinger, Sustainability Expert, Swiss Re

"Today, climate change is a fact. And change presents us with both risks and opportunities." Ivo Menzinger and his team identify environmental risks and help develop business strategies to cope with them. Swiss Re was among the first to recognize the potential impact of climate change on the financial services industry and to study effective ways of managing associated risks. Combining expertise and financial strength, Swiss Re is ideally positioned to provide your company with tailored solutions to mitigate your exposure and protect your position should uncertainty in a climate of uncertainty. Visit your local agent at www.swissre.com.

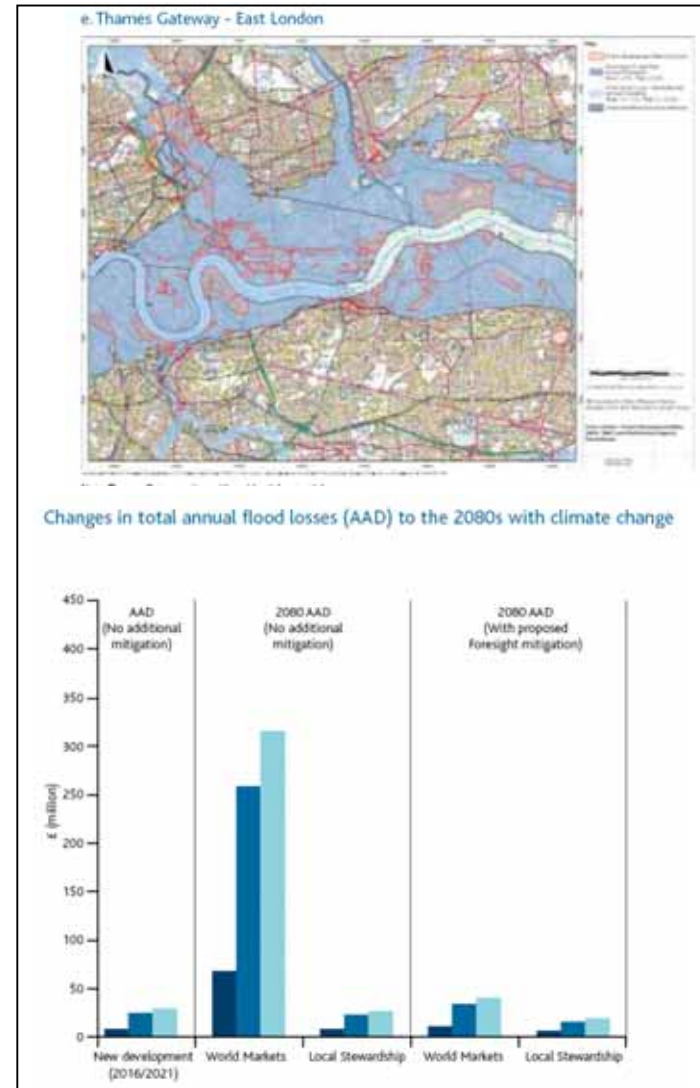
Expertise you can build on. **Swiss Re**



Participating in the Formulation of Public Policy

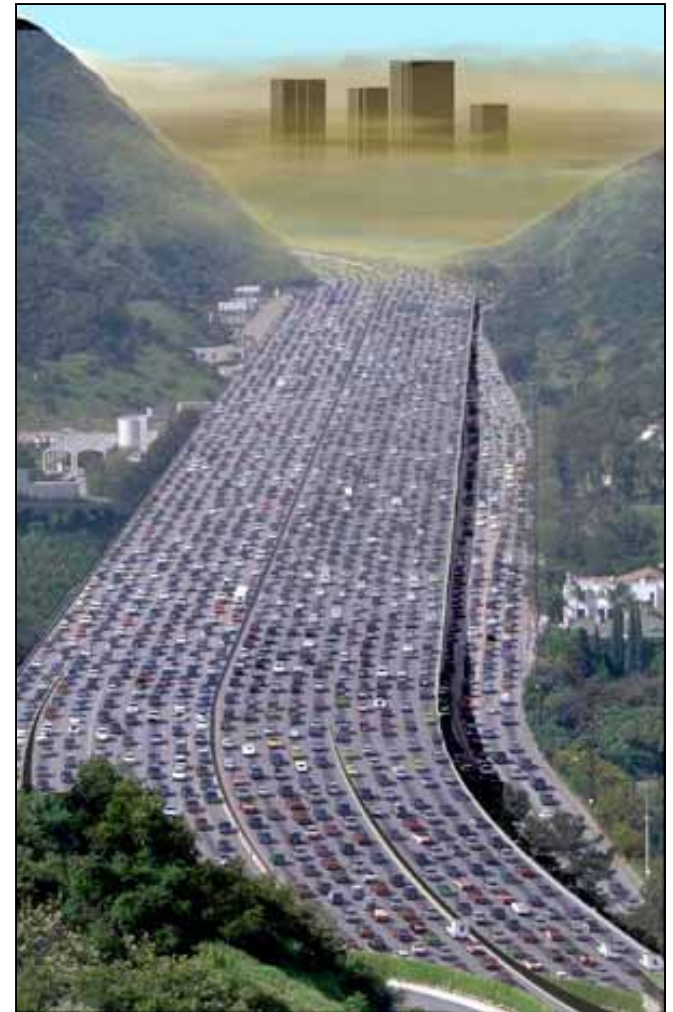
Having a Voice in Public Policy Discussions on Climate Change

- **Association of British Insurers:** advising City of London on land-use planning and flood defenses
- **Allianz:** endorsed the CERES/INCR “Call to Action” 50 companies; \$4T invested
- **UNEP Initiative**



Endorsing Voluntary Energy-Saving Policies

- *American Insurance Association:*
Endorsing public transportation; reduced speed limits; telecommuting based on win-win benefits



Promoting Energy-Efficiency Codes and Standards

- *IBHS*
- *Building Code Assistance Project*

• B C A P •
Building Codes Assistance Project

I want to subscribe to the bi-monthly Status of State Codes Newsletter
Last Updated May 9, 2007, 11:31 PM

Home About Us Contact Us

The Building Codes Assistance Project is dedicated to assisting states in the adoption and implementation of statewide building energy codes.

The value of energy efficiency in properly implemented construction standards is universally recognized as the easiest and most cost-effective way to help consumers save energy and money, make housing more affordable, and reduce air pollution. All of these benefits are difficult or impossible to capture if not taken into consideration at the time of construction.

BCAP was established in 1994, as a joint initiative of the Alliance to Save Energy, the American Council for an Energy-Efficient Economy, and the Natural Resources Defense Council. Support for this website and for BCAP's advocacy and technical assistance work comes from the US Department of Energy.

"Reducing the Nation's energy consumption through the adoption, implementation, and utilization of building energy codes and standards."

Status of State Codes Maps & Overviews

Latest News:

- [Louisiana](#) - Legislative efforts to roll back the 2006 IRC May 10, 2007
- [Tennessee](#) - Senate passes bill mandating 2003 IECC May 10, 2007
- [Oregon](#) - Code proposal for 2008 ORSC under review May 07, 2007
- [Wisconsin](#) - Wisconsin reviewing 2006 IECC for adoption May 07, 2007
- [New Mexico](#) - New Mexico to adopt 2006 IECC May 07, 2007

Committee formed for development of green building standard.

The U.S. Green Building Council (USGBC), American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), and the Illuminating Engineering Society of North America (IESNA) have completed formation of the committee charged with the [development of Standard 189P](#), the ASHRAE/USGBC/IESNA minimum standard for high-performance green building. The proposed green building standard is being developed by the three organizations to help drive green building into mainstream building practices and is scheduled for completion in 2007.

ICC proposed changes online. View the proposed changes by clicking [here](#).

IRS Issues Guidance on Commercial Building Tax Deduction. View Guidance Notice [here](#).

2006 IECC is Printed and Available for Purchase [Read more](#) or [purchase](#) the code

The Clean Energy-Environment Guide to Action: Policies, Best Practices, and Action

Leading by Example

In-House Energy/Carbon Management

- **Swiss Re:** “Gherkin” building (London)
- **Rutherford:** first insurance broker to go “carbon neutral”
- **West Bend Mutual Insurance Company:** reported a 7% increase in productivity following energy-efficiency upgrades



Reducing Insurers' Carbon Footprint Through Improved Operations

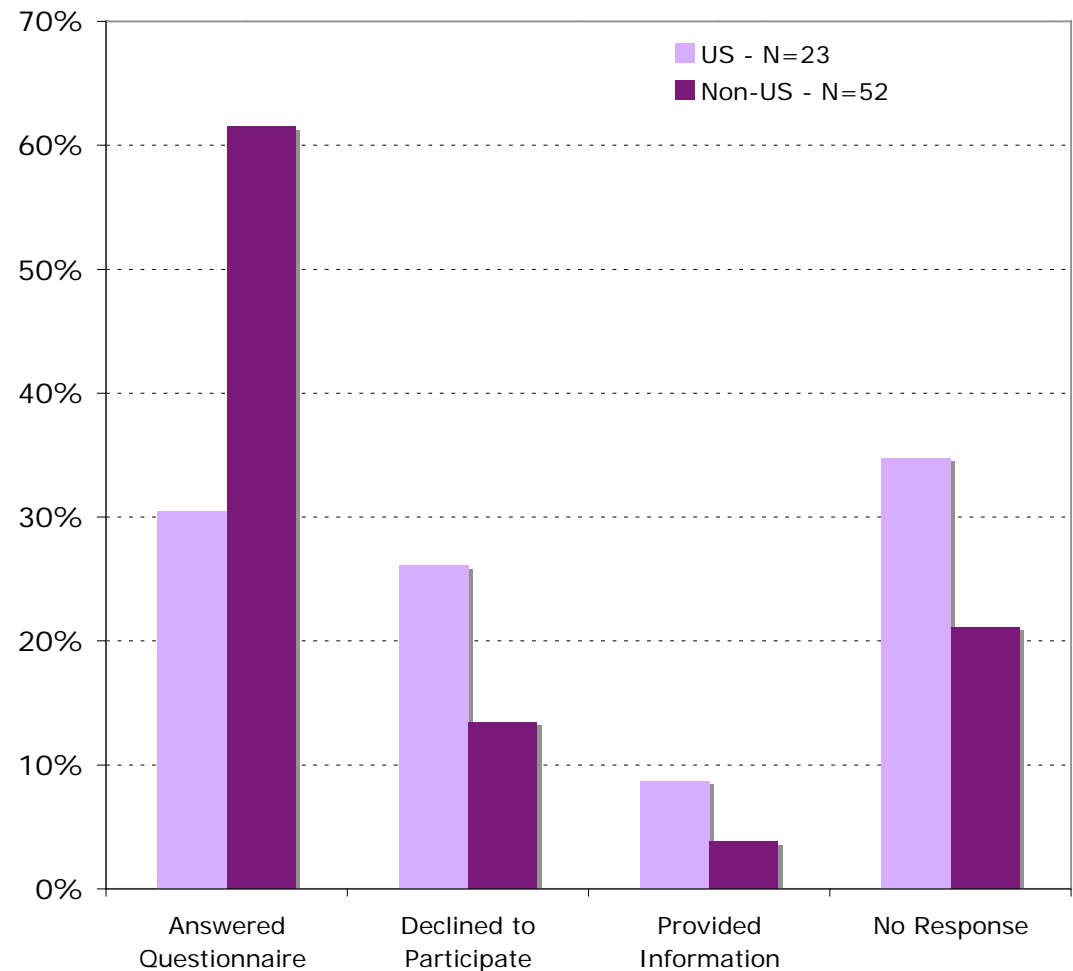
- *American Modern Insurance Group:* using PV-powered portable offices for post-disaster claims handling



Disclosing Climate Vulnerabilities & Liabilities

Insurers responding to CDP (\$41 T under management):
AIG, Aon, Marsh & McLennan, MBIA, Safeco, St. Paul Travelers, Unum Provident, Munich Re, others...

Insurer Response Rates to Carbon Disclosure Project (CDP) Survey: 2006



Source: <http://www.cdproject.net/>

Closing Thoughts:

**Risks Profiles of Responses
to Climate Change**

Risks are also associated with responses to climate change



- **Emissions reduction:** supply- and demand-side
 - Green buildings
 - Nuclear power
 - Hydrogen energy
 - Renewable energy
 - Carbon capture & storage

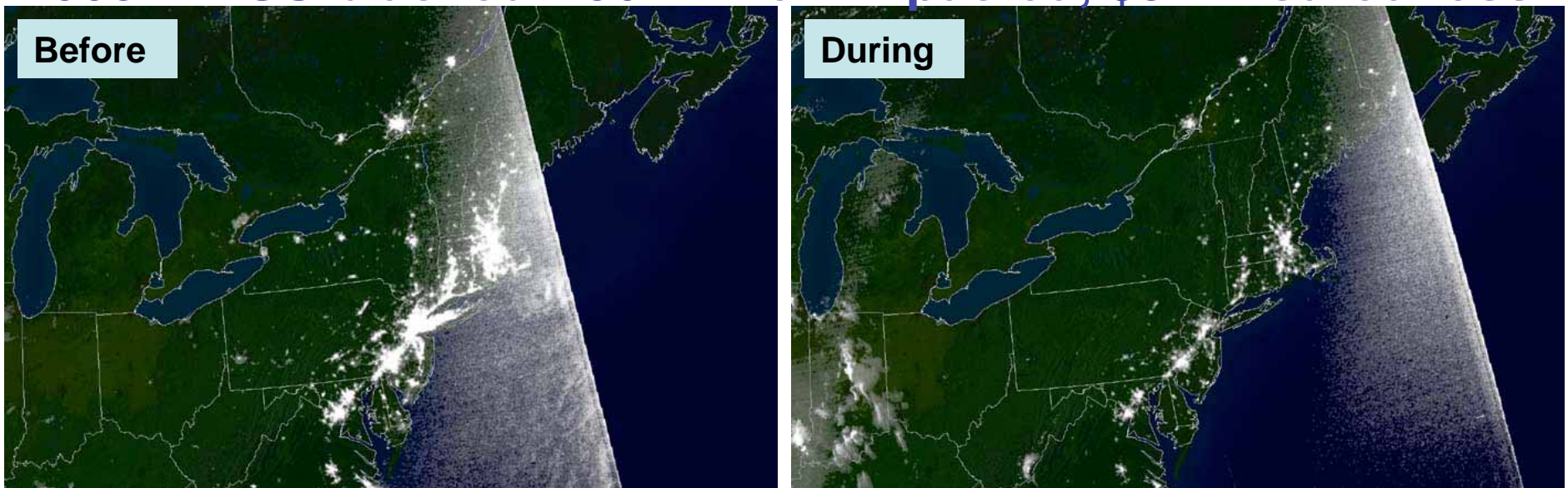
Carbon Capture and Storage (CCS)

- Lake Nyos - 1986
(Cameroon):
Natural CO₂ leak
killed 1800 people,
3500 farm animals



Co-Benefits: Insurance Loss Reduction + Lower Emissions

2003 NE US blackout: 50 million impacted, \$3B insured loss

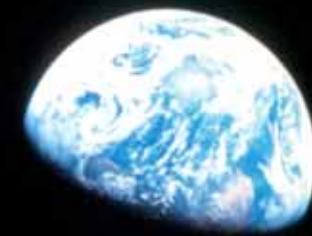


Sources: Imagery NOAA/DMSP; Losses Munich Re - "Failure of Public Utilities"

- Energy efficiency avoided up to 155 hours of blackout in California in 2000 (worth \$20B)
- Distributed renewable generation can reduce business interruptions



Thank You



<http://insurance.lbl.gov>

Thank You



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